AP® Chemistry
Wachusett Regional High School
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Course Description

AP® Chemistry is designed to be the equivalent of a first year college general chemistry course and follows the College Board's AP® Chemistry syllabus. As such, the course is suitable for the best and brightest at the regional that have excelled in their first year chemistry course. Students wishing to take AP® Chemistry must exhibit high levels of commitment, motivation, and academic maturity. This course presents a rigorous treatment of the following concepts: the nature of matter, gas laws, thermodynamics, stoichiometry, bonding, chemical kinetics, chemical equilibria, and more. Successful completion of this course requires strong math skills, and students will also develop the ability to tie multiple concepts into one complex calculation. These problem-solving strategies obtained during this course will prepare college-bound students for careers in the sciences, medicine, engineering, and other technical areas.

This course will nurture the student's ability to incorporate mathematical skills in the solution of chemistry problems, both through the use of textbook problems and laboratory activities. Since the AP® exam no longer allows the use of calculators during specific sections, significant emphasis will be placed on developing the student's ability to solve problems through dimensional analysis and estimation. Students will be required to do extensive writing, and to keep a thorough and accurate laboratory notebook.

To cover all of the material in the appropriate depth, AP® Chemistry will meet as a class and a half in the 14-day rotating schedule. This means the class meets for a total of 11 hours every 14 school days, instead of the usual 7 hours of class time for a regular class. Labs will be accommodated during the double periods or the period + 90-minute long-block combination, which occur at least once every school week.

AP® Chemistry requires extensive laboratory work to reinforce and demonstrate key course concepts and ready the student for college chemistry. Each student is required to keep a detailed lab notebook. This notebook will be used to record every procedure, observation, and calculation. Each lab will also require a written lab report, where the student will explain and outline each facet of the experiment conducted.

The students' grade will be calculated by taking a percentage of points you have compared to how many you could have. It is imperative that each student behaves properly, respect each other, respect the instructor, and respect the room in which the class is taught. Inappropriate behavior will not be tolerated in any form, especially in the laboratory. Lab safety is of the utmost importance. Any misconduct during a laboratory will result in a zero for that lab assignment.

Required Materials

All students are expected to bring a writing implement, scientific calculator (**graphing calculators are prohibited**), and a three ring binder to each class. A three ring binder to accommodate class notes, homework, handouts, quizzes, tests, and other class work is required. Students also need a composition notebook to outline each laboratory procedure. Students will not be supplied any of these items if they are forgotten. Promptness is also desired. After a student's first late arrival I will deduct one point from your point totals, which can have a dramatic impact on your grade.

Text

Chemistry by Zumdahl and Zumdahl, 7th ed., Houghton Mifflin Company, 2007.

Lab Resources

Laboratory Experiments for Advanced Placement Chemistry by Vonderbrink, Flinn Scientific, Inc., 1995.

Laboratory Investigations: AP® Chemistry by David Hostage and Martin Fosset, People's Education, 2006.

Additional lab assignments that have been recommended and obtained from the following AP workshops will also be used.

AP® Institute at St. Johnsbury, St. Johnsbury, VT.

Taft AP® Institute at the Taft School, Waterbury, CT.

Laboratory assignments will be taken from these sources and will be given to students as handouts.

Course Overview *(Note: that labs may be done out of sequence and dates may change based on progress)*

Chapter 1: Chemical Foundation **Summer Work (Due August 17th)**

Topics Covered: Scientific Method, Units of Measurement, Significant Figures, Dimensional Analysis, Temperature, Density, Classification of Matter

Lab Experiment: Basic Laboratory Equipment, Procedures, and CBL Refresher

Chapter 2: Atoms, Molecules, and Ions **Aug 28th-7th (1.5 Weeks)**

Topics Covered: Fundamental Chemical Laws, Dalton's Atomic Theory, Atomic Structure and Classic Experiments, Modern Atomic Theory, Molecules, Ions, Periodic Table, Naming Simple Compounds

Lab Experiment: Empirical Formula of Magnesium Oxide

Chapter 3: Stoichiometry **Sept. 10th-14th (1 Week)**

Topics Covered: Atomic Masses, Mole Concept, Percent Composition, Formula Determination, Balancing Chemical Equations, Stoichiometric Calculations, Limiting Reactant

Lab Experiments: The Size of a Molecule (Calculating Avogadro's Number)
Gravimetric Analysis of Epsom Salt
Job's Method of Continuous Variation

Chapter 4: Types of Reactions and Solution Stoichiometry **Sept. 17th-Oct. 9th (3 Weeks)**

Topics Covered: Water, Nature of Aqueous Solutions, Electrolytes, Composition of Solutions, Types of Reactions, Precipitation Reactions, Ionic Equations, Precipitation Stoichiometry, Acid-Base Reactions, Balancing Redox Reactions

Lab Experiments: Qualitative Analysis (Identification Through Precipitation Reactions)
Acid-Base Titration (Volumetric Analysis)
Redox Titration

(Course Overview con't)

Chapter 6: Thermochemistry **Oct. 10th-24th (2 Weeks)**

(Note: Chapter 5: Gases has been skipped to cover at a later date. This is done to get to the harder material (Equilibrium, Rate Laws) faster and to spend more time with them.)

Topics Covered: Nature of Energy, Enthalpy and Calorimetry, Hess's Law, Enthalpies of Formation, Present and New Sources of Energy

Lab Experiments: Calorimetry of Endothermic and Exothermic Reactions
Thermochemistry and Hess's Law

Chapter 7: Atomic Structure and Periodicity **Oct. 25th-Nov. 7th (2 Weeks)**

Topics Covered: Electromagnetic Radiation, Bohr Model, Bright Line Spectra, Quantum Model of the Atom, History of the Periodic Table, Periodic Trends in Atomic Properties, Group Properties

Lab Experiments: Atomic Spectroscopy and Bohr's Model

Flame Tests Revisited

Chapters 8 & 9: Bonding: General Concepts **Nov. 8th- Nov. 20th (1.5 Weeks)**
Covalent Bonding: Orbitals

Topics Covered: Types of Bonds, Electronegativity, Bond Polarity, Ionic Compounds, Bond Character, Covalent Bonds, Bond Energies and Reactions, Lewis Structures, Octet Rule and Exceptions, Resonance, VSEPR, Hybridization, σ- and π-bonds

Chapters 10 & 11: Liquids and Solids **Nov. 26th– Dec. 7th (2.5 Weeks)**
Properties of Solutions

Topics Covered: Intermolecular Forces, The Liquid State, Types of Solids, Metallic Bonding, Molecular Solids, Ionic Solids, Vapor Pressure and Changes of State, Phase Diagrams**,** Solution Composition, Energies of Solution Formation, Solubility, Vapor Pressure, Colligative Properties, Boiling Point Elevation, Freezing Point Depression, Osmotic Pressure, Colloids

Lab Experiment: Molar Mass by Freezing Point Depression

Chapter 12: Chemical Kinetics **Dec. 10th - Dec. 21st(2 Weeks)**

Topics Covered: Reaction Rates, Rate Laws, Determining the Form of a Rate Law, Integrated Rate Law, Reaction Mechanisms, Collision Theory, Catalysis

Lab Experiments: Rate Law Determination of the Crystal Violet Reaction
Differential and Integrated Rate Laws

Chapter 13: Chemical Equilibrium **Jan. 2nd-Jan. 15th (2 Weeks)**

Topics Covered: Equilibrium Condition, Equilibrium Constant, Pressure and Equilibrium, Heterogeneous Systems, Applications of K, Equilibrium Calculations, Le Châtlier's Principle

Lab Experiment: Determination of Equilibrium Constant for the Formation of $FeSCN^{2+}$

(Course Overview con't)

Chapter 14: Acids and Bases **Jan. 17th-Jan. 31st (2 Weeks)**

Topics Covered: Nature of Acids and Bases, Acid Strength, pH Scale, pH Calculations for Strong and Weak Acids, Bases, Polyprotic Acids, Acid-Base Properties of Salts and Oxides, Lewis Acids and Bases

Lab Experiments: Finding Mass Percent of Acetic Acid in Vinegar
Determination of Acid Ionization Constant of a Weak Acid

Chapter 15: Application of Aqueous Equilibria **Feb. 1st-Mar. 1st (3 Weeks)**

Topics Covered: Acid Base Equilibria, Common Ion Effect, Buffered Solution, Titrations, pH Curves, Indicators, Solubility Equilibria, Solubility Product Constant, Precipitation Reactions, Complex Ion Equilibria

Lab Experiments: Titration Curve Lab
Determination of the Equilibrium Constant of an Indicator
Determination of the Solubility Product Constant of Calcium Hydroxide

Chapter 18: The Nucleus: A Chemists View **February Break**

Topics Covered: Nuclear Stability and Radioactive Decay, Nuclear Transformations, Detection and Uses of Radioactivity, Stability of the Nucleus, Nuclear Fission and Fusion, Effects of Radiation

Chapter 16: Spontaneity, Entropy, and Free Energy **Mar. 4th-Mar. 13th(1.5 Weeks)**

Topics Covered: Spontaneity of Processes, Entropy, Second Law of Thermodynamics, Free Energy, Entropy Changes, Free Energy in Chemical Reactions, ΔG and Pressure, ΔG and Equilibrium, ΔG and Work

Chapter 17: Electrochemistry **Mar. 14th-Mar. 22nd (1.5 Weeks)**

Topics Covered: Galvanic Cells, Standard Reduction Potentials, Cell Potential, Electrical Work, and Free Energy, Dependence of Cell Potential on Concentration, Batteries, Corrosion, Electrolysis

Lab Experiment: Electrochemical Cells

Chapter 22: Organic Chemistry **Mar. 25th –Mar. 29th (1 Week)**

Topics Covered: Alkanes, Alkenes, Alkynes, Nomenclature of Organic Compounds, Reactions of Organic Compounds, Functional Groups

Lab Experiments: Modeling Lab
Electrolytic Synthesis of Iodoform

Chapter 5: Gases **Apr. 1st- Apr. 12th(1.5 - 2 Weeks)**

Topics Covered: Pressure, Boyle's Law, Charles' Law, Avogadro's Principle, Ideal Gas Law, Gas Stoichiometry, Dalton's Law, Kinetic Molecular Theory, Effusion and Diffusion, Real Gases

Lab Experiments: Molar Mass of a Volatile Liquid
Molar Volume of Gas

(Course Overview con't)

AP® Exam Review and Preparation **Apr. 22nd - May 3rd (2 Weeks)**

During this time we will review material, discuss the examination, test taking strategies, and how multiple concepts that we have discussed will be bridged together. This will be accomplished by review lab reports, past exam questions from the multiple-choice sections and open-response, and practice tests will be administered. Emphasis will be placed on ionic equations, equilibrium problems, predicting redox reactions, and solubility rules.

AP Chemistry Exam **May 6th**

TBD

After the Exam

Decompression, Airbag Lab, Unknowns Lab, Acid ID Lab, Analysis of Antacid Lab

Senior Exams **Last Week in May**

Congraduations